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NATIONAL TRANSPORTATION SAFETY BOARD  
WASHINGTON, D.C. 20594

PIPELINE ACCIDENT REPORT

Adopted: December 9, 1976

STANDARD OIL COMPANY OF CALIFORNIA  
PIPELINE RUPTURE  
LOS ANGELES, CALIFORNIA  
JUNE 16, 1976

SYNOPSIS

At 10:32 a.m., on June 16, 1976, an 8-inch pipeline owned by the Standard Oil Company of California was struck and ruptured by excavation equipment, which was working on a road-widening project. Gasoline sprayed from the rupture and drenched nearby buildings. Ninety seconds later, the gasoline ignited; the ensuing fire killed 9 persons, injured 14 persons, and caused extensive property damage.

The National Transportation Safety Board determines that the probable cause of the accident was the rupture of the pipeline by the excavation equipment, whose operator was unaware of the pipeline's precise depth and location. Although the line was known to exist, its precise depth and location were not known by the pipeline operator, the construction contractor, the subcontractor, or the California Department of Transportation.

INVESTIGATION

The Accident

On June 16, 1976, the operator of a front loader (skip loader) was excavating the median in the 9400 block of Venice Boulevard near its intersection with Bagley Avenue in Los Angeles, California. Venice Boulevard is a heavily traveled thoroughfare with a wide median separating its eastbound and westbound lanes. The median was to be excavated, filled with crushed stone, and then paved for traffic. Work on this road-widening project had been in progress for 9 months and was 41 percent completed. Although traffic was not heavy at the time, some automobiles were parked at the curb and some were moving on the westbound lanes.

Seven two- and three-story commercial buildings of frame, brick, and stucco construction were located in this block. People were inside the buildings and pedestrians were passing on the sidewalk.

At 10:32 a.m., P.d.t., the bucket of an 8-inch, petroleum products pipeline above the final grade of the pipeline of 550 psig, gushed and sprayed up and down the Venice Boulevard median.

Pipeline System

The ruptured 8-inch pipeline was owned and operated by the Standard Oil Company of California (SOCAL). The pipeline was not a common carrier because it pumped only the refined petroleum products of SOCAL. The pipeline extends 25 miles from SOCAL's El Segundo refinery to its terminal at Van Nuys. The first 8.4 miles of the pipeline from El Segundo to the Culver City terminal consists of 6-inch pipe. The next 16.6 miles from Culver City to Van Nuys consists of 8-inch pipe. Approximately 1 1/2 miles of the 8-inch pipeline segment was located underneath the Venice Boulevard median. (See figure 4.)

The pipeline, which was constructed in 1963, was coated with Somastic and cathodically protected against corrosion. A franchise from the city of Los Angeles permitted SOCAL to place the pipeline beneath certain city streets. "As built" drawings showing the location of the pipeline under the streets were filed in the city engineer's office.

The ruptured pipe had the following specifications:

- 8 5/8-inch outside diameter (OD)
- API 5L X-46 seamless steel
- .219-inch wall thickness
- 19.64 pounds per lineal foot
- 2,340 psig internal pressure at specified minimum yield strength
- 3,200 psig internal pressure at ultimate bursting strength

Between the Culver City and Van Nuys terminals, in the 8-inch pipeline segment, two full-opening, manually operated valves were installed. No automatically or remotely operated valves were installed on this segment except at the terminals.

After construction, the pipeline was tested hydrostatically to 1,850 psig for 24 hours. SOCAL has no record of any corrosion leaks in this pipeline system.

The Los Angeles franchise, as amended in 1968, specified that a new pipeline must be hydrostatically tested for 24 hours after construction. A hydrostatic retest must be performed 10 years after construction and every year thereafter. Each test must be held for 4 hours. SOCAL hydrostatically retested the pipeline to 1,750 psig for 4 hours in 1973, 1974 and 1975. On July 27, 1974, during the retest, a leak developed in a 3/8-inch dent in the pipe; the failed section was repaired. After the accident of June 16 the pipeline was retested to 1,000 psig and held for 20 hours and then tested to 1,750 psig for 4 hours.

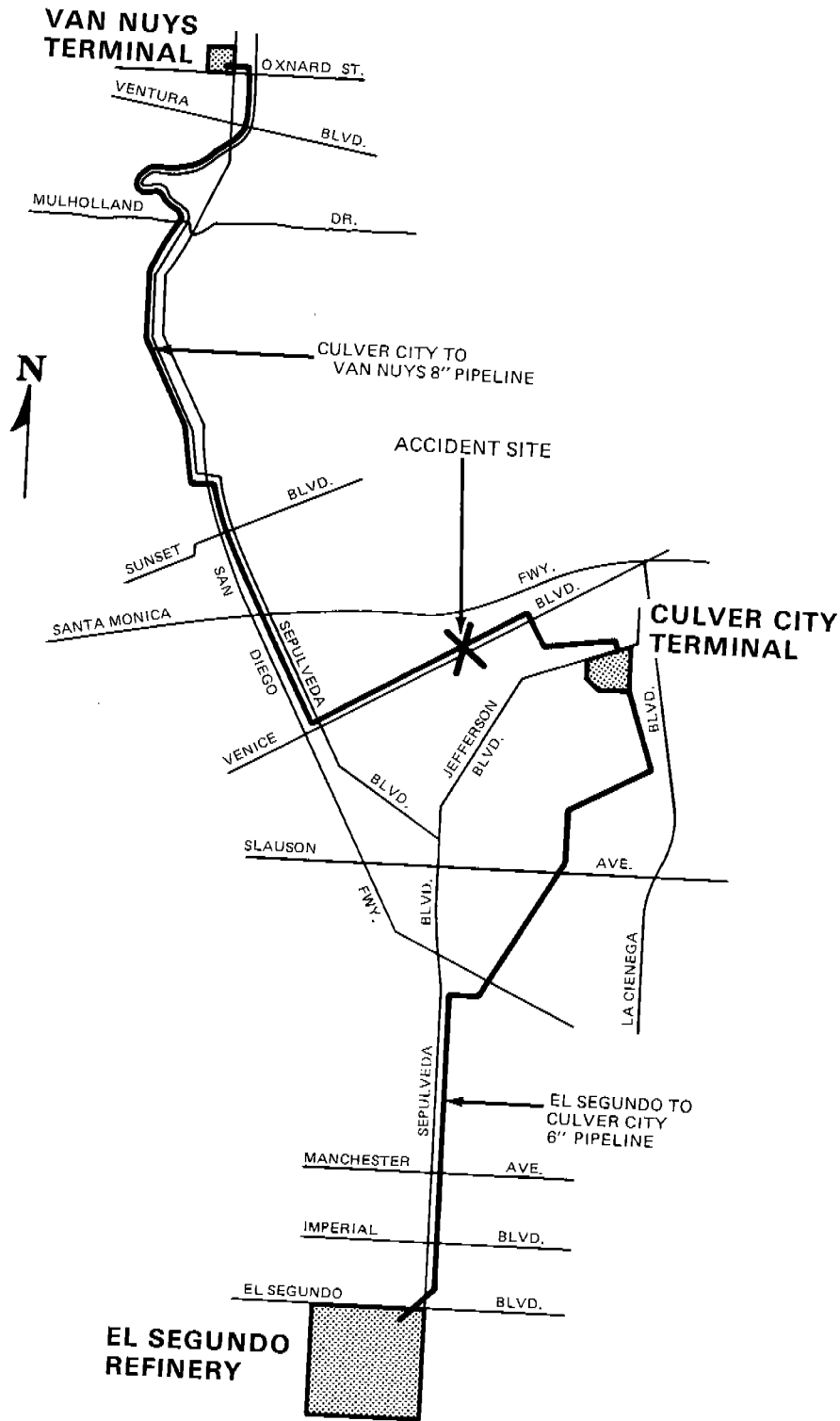


Figure 4. Plan of pipeline route.

The pipeline operation is controlled by the SOCAL dispatcher at El Segundo. A computer monitors the operation by scanning every meter on the system at the same time. It calculates the number of barrels of product entering the pipeline, compares that figure to the number of barrels of product leaving the system, and alarms the dispatcher if the variance between the input and output exceeds certain amounts. On this system the following conditions would initiate the alarm:

Level-1 alarm. -- If the variance between the input and output meters is 2 barrels (84 gallons) or more during any single minute, the dispatcher will shut down the pipeline and begin an investigation to determine the cause of the variance.

Level-2 alarm. -- If the variance between the input and output meters is 1.5 barrels (63 gallons) or more during three consecutive scans, the dispatcher will shut down the pipeline and begin an investigation to determine the cause of the variance.

Level-3 alarm. -- If the variance between the input and output meters is .3 barrels (12.6 gallons) or more during 8 out of 10 scans, the dispatcher may check the system without shutdown to determine the cause of the variance. The system will not be allowed to operate under this condition, however, for more than a few scans.

Level-4 alarm. -- If the variance between the input and output meters is .1 barrels (4.2 gallons) or more during 18 out of 20 consecutive scans, the dispatcher will take action similar to that required for a level-3 alarm.

On June 16, 1976, the computer sounded an alarm and notified the dispatcher of a level-1 leak at 10:32:12 a.m. At 10:35:28 a.m. the pump at El Segundo was shut down; the motor-operated valve at the Van Nuys terminal was closed at 10:36:08 a.m., and the motor-operated valve at the Culver City terminal was closed at 10:36:22 a.m.

#### Meteorological Information

The weather at 10:30 a.m. was both foggy and hazy with a visibility of 3 miles. The temperature was 65°F, the wind was from the west-southwest at 9 knots, and the ceiling 1,300 feet, broken.

#### Fire

Within 90 seconds of the rupture the spraying, vaporizing gasoline ignited; one witness stated that the fire initiated from beneath a truck. A low-order explosion, and what sounded like a clap of thunder, followed the ignition. A ball of fire rolled skyward followed by dense, black clouds of smoke. Flames then engulfed the gasoline-drenched buildings and flashed back to the gasoline pool at the pipeline rupture.

The Los Angeles Fire Department received the alarm at 10:34 a.m., and the first firefighting equipment arrived at 10:39 a.m. Some equipment pumped water on the seven buildings, while other equipment pumped foam and chemicals on the gasoline fire at the rupture. The fire department ordered the evacuation of all residents on Cardiff and Bagley Avenues north of Venice Boulevard. The Los Angeles Police Department completed the evacuation at 12:30 p.m.

At 11:10 a.m., a manually-operated valve on the pipeline was closed; this isolated the rupture within a 2.5 mile segment. The gasoline fire at the rupture was smothered at 12 noon; the 3 building fires were under control by 2 p.m. The evacuated residents were allowed to reenter their homes at 4:59 p.m.

A Los Angeles Police Department patrol car saw the fire at 10:35 a.m. and reported it. The police established a two-block perimeter around the area to control the flow of disrupted traffic, to prevent looting, to maintain order, and to allow for the orderly flow of ambulances and firefighting equipment. More than 150 policemen and 150 firemen were on duty at the accident site.

#### Survival Aspects

The paramedics at the scene reported 2 fatalities and 21 persons hospitalized. Two additional persons died within 24 hours. Of these four fatalities, three died from burns and one died from a heart attack. Five persons died later from burns. The remaining 14 persons that were hospitalized recovered.

#### Other Information

Events preceding the accident. -- The State of California Department of Transportation (CALTRAN) contracted with the Griffith Company (Griffith) for the widening to 6 lanes of 2.2 miles of Venice Boulevard. Griffith, the prime contractor, hired C. W. Poss, Inc. (Poss) as a subcontractor for some of the excavation work. Construction was to begin at Keystone Avenue and end at Cadillac Avenue. The accident site, between Cardiff and Bagley Avenues, was located within the construction section. The project was allotted 380 working days for completion; a penalty clause specified that \$525 per day would be assessed for each calendar day's delay in finishing the work. Work was to begin on September 11, 1975. On the day of the accident Griffith was in its 192nd day of work and the project was approximately 41 percent completed. "Special Provisions" of the contract (see appendix B) provided:

"Attention is directed to the possible existence of underground main or trunk line facilities not indicated on the plans or in the special provisions and to the possibility that underground

main or trunk lines may be in a location different from that which is indicated on the plans or in the special provisions. The Contractor shall ascertain the exact location of underground main or trunk lines whose presence is indicated on the plans or in the special provisions, the location of their service laterals or other appurtenances, and of existing service laterals or appurtenances of any other underground facilities which can be inferred from the presence of visible facilities such as buildings, meters and junction boxes prior to doing work that may damage any of such facilities or interfere with their service."

CALTRAN held two preconstruction meetings regarding the Venice Boulevard project in September and October 1975 to discuss the general aspects of the job including the location of and possible interference of existing water, sewer, gas, and petroleum pipelines, telephone cables, electrical conduits and other facilities. These facilities were marked on the construction prints, but the dimensions were approximate. SOCAL did not attend either of these meetings, but it did submit a drawing showing its pipeline location to be approximately 42 inches below the surface of Venice Boulevard. The contract specified the median be excavated 2.05 feet (24.6 inches) below the surface of Venice Boulevard; the 17.4-inch difference was assumed to be the dirt cover over the pipeline after excavation was completed. As a result of these meetings both Griffith and Poss believed that the SOCAL pipeline had sufficient cover. The loader operator had the same understanding; he knew the pipeline was there, but he believed it was well below his excavation.

Union Oil Company of California (Union) owns and operates a 6-inch, crude petroleum pipeline located under the Venice Boulevard median parallel to, and to the south of, SOCAL's 8-inch pipeline in the area of the accident. CALTRAN provided Union with both plan and profile drawings for the Venice Boulevard project, and Union sketched the approximate location of its pipeline on each of these drawings and returned them to CALTRAN.

As the work progressed, both Union and SOCAL were contacted and asked to mark their pipelines. Union marked its pipeline approximately 40 times. At some locations the markings were destroyed by construction and had to be replaced. SOCAL dug several testholes to locate its pipeline. In one area on Venice Boulevard about 1,000 feet west of Cardiff Avenue, SOCAL lowered 700 feet of the pipeline because it was not buried deep enough and would have been in the path of the excavation. At that location the pipeline's cover varied from 3 feet 2 inches to 3 feet 8 inches. SOCAL had dug one testhole 328 feet west of the ruptured pipe and another 300 feet east of it. A SOCAL employee, assigned to patrol this pipeline segment, stated that he met with CALTRAN personnel in January 1976 to advise them that testhole measurements of SOCAL's pipeline indicated that in several locations it was closer to the subgrade than originally thought to be. SOCAL's last formal contact with either



the contractor or CALTRAN was in February 1976 -- 4 months before the accident. SOCAL did not assign an inspector to monitor this construction. However, SOCAL personnel periodically patrolled the pipeline, checked the construction progress, and talked to the contractor at these times.

Data: Pipeline Ruptures by Construction Equipment. -- Accident report data submitted to the Office of Pipeline Safety Operations of the U. S. Department of Transportation by the liquid petroleum pipeline operators from 1968 through 1975, indicate that pipeline ruptures by construction equipment has moved from the second-largest cause of pipeline accidents to the first-largest cause of pipeline accidents.

Prevention of damage to pipeline. -- On April 18, 1972, the Safety Board conducted a symposium, "Prevention of Damage to Pipelines;" representatives of 24 pipeline, other underground facilities, construction, labor, and government organizations participated.

On July 27, 1973, as a result of the symposium findings, the Safety Board issued a special study, "The Prevention of Damage to Pipelines" (NTSB-PSS-73-1). The study discussed the damage-prevention responsibilities of government agencies, excavators, contractors, and pipeline operators. It reviewed programs, methods, and devices that had proved effective in preventing damage to pipelines. The study examined laws and proposed laws concerning pipelines in several States and localities. A model statute issued by the Office of Pipeline Safety Operations of the U. S. Department of Transportation was discussed. The study contained recommendations that were intended to help prevent future damage-related pipeline accidents.

The report concluded, in part, that pipeline accidents caused by excavation and construction activities can be prevented, but the major effort must come at the local level and must involve the complete cooperation of the operators of underground facilities, the individual contractors, the contractor associations, the local and State governments, and the planners and developers.

Regulations should require the notification of excavation projects and should permit the underground facility operators a flexible, convenient system of receiving such notification. Penalties for violating the regulations should be severe enough to deter potential violators and to encourage cooperation and participation by all parties.

The Safety Board recommended that the American Public Works Association (APWA) establish a National Organization of Utility Coordinating Committees, encourage its local chapters to establish utility coordinating committees and to develop guidelines for coordinating and regulating construction near underground facilities. As a result of this recommendation and the excellent work of the APWA's new Utility Location and Coordination Council, 34 States

now operate 82 "one-call" systems <sup>1/</sup> for the notification and coordination of construction activities. When the Safety Board's special study was released only a handful of these systems were in operation.

The Safety Board also recommended that the American Petroleum Institute (API) develop guidelines to assist liquid petroleum pipeline operators to establish excavation-oriented damage prevention programs. The API, rather than develop a separate set of guidelines, has endorsed the work of the APWA in this area. The API has mailed the APWA guidelines to its pipeline members and urged their participation in the program.

At the time of this accident, a "one-call" system, the Underground Service Alert (USA), was operating in northern California. SOCAL is a USA member, but CALTRAN, a member at one time, is not now participating. A "one-call" system had been proposed but not put in operation in southern California at the time of the accident. Since the accident the southern California system has become operational in some areas but not yet in Los Angeles County.

#### ANALYSIS

Griffith's subcontractor, Poss, was leveling and smoothing the area to the final grade and loading the excavated material onto a truck when its loader hit the pipeline. No one, including the equipment operator, knew how close the equipment was to the pipeline. No one had given the operator a precise location and he assumed the pipeline had sufficient cover.

Griffith knew that the pipeline existed because it was shown on CALTRAN's construction prints. However, CALTRAN did not have the pipeline accurately marked on the prints because SOCAL had provided CALTRAN with only an approximate location of its pipeline taken from their "as built" drawings.

As the project progressed, Griffith called in SOCAL to ascertain the precise line location several times. SOCAL dug testholes several times to locate the line and at one location lowered 700 feet of line because its burial depth was too shallow. At the accident site, however, Griffith had not had the line location determined precisely. The testholes that SOCAL had dug 300 feet east and 328 feet west of the rupture certainly should not have been considered as assurance that all of the pipeline was at the same depth within that 628 feet.

Although CALTRAN had a clause in its construction contract making Griffith contractually responsible for determining the precise location of any underground facility before excavation commenced, CALTRAN should have monitored this construction more closely to insure that the contractual obligation was fulfilled.

<sup>1/</sup> A "one-call" system permits an excavator to report his proposed project to all the operators of underground facilities participating in the system by making one telephone call.

The four parties involved each knew that an 8-inch, gasoline pipeline existed in the work area. However, the parties, neither individually nor collectively, showed enough concern to insure that the line was precisely marked at all times and monitored continuously.

All of the parties involved in construction activities have some measure of responsibility in preventing damage to buried pipelines and other facilities, but the operators of these facilities have the greatest responsibility. There is a need to impose controls that specify responsibilities and efforts to prevent damage.

Liquid petroleum pipeline industry statistics show that pipeline ruptures by construction equipment have supplanted corrosion as the primary cause of pipeline accidents. The Safety Board believes that corrosion-caused pipeline accidents have been reduced as a result of Federal regulations and by the special attention given this area by the operators. Pipeline operators' participation in "one-call" systems has proven to be effective in reducing excavation-related damage. The Safety Board believes that as more pipeline operators participate in these systems, excavation-caused accidents will be reduced markedly. Participation in the "one-call" systems should be voluntary. However, if voluntary participation is unsuccessful, then legislative or regulatory methods should be considered to require participation. Additionally, "one-call" systems are more effective and less costly when all underground facilities operators participate. The existence of a "one-call" system greatly increases the awareness of accident possibilities and of the need for closer coordination and communication.

#### CONCLUSIONS

1. The 8-inch, gasoline pipeline was hit and ruptured by the subcontractor's excavation equipment because the equipment operator, although aware of the pipeline's existence, believed it to be buried deeper.
2. SOCAL, when it supplied CALTRAN with information about the location of its pipeline in the median of Venice Boulevard, failed to provide the precise pipeline depth at the accident site and did not monitor the construction activities continuously.
3. No attempt was made to verify the pipeline depth at the accident site by the four parties, even though 700 feet of the pipeline near the accident site had been previously lowered because of insufficient depth; the two testholes dug by SOCAL 628 feet apart were spaced too far for an accurate depth determination of the pipe at the point of rupture.
4. No "one-call" system was in effect in the area at the time of the accident.

5. High-pressure pipelines require more and closer monitoring in congested areas than in rural areas to guard against excavation damage.

#### PROBABLE CAUSE

The National Transportation Safety Board determines that the probable cause of the accident was the rupture of the pipeline by the excavation equipment, whose operator was unaware of the pipeline's precise depth and location. Although the line was known to exist, its precise depth and location were not known by the pipeline operator, the construction contractor, the subcontractor, or the California Department of Transportation.

#### RECOMMENDATIONS

As a result of its investigation of this accident, the National Transportation Safety Board made the following recommendations:

-- to the Standard Oil Company of California:

"Submit precise, accurate data concerning the depth and location of its pipelines for all future construction projects. (Class II, Priority Followup) (P-76-87)

"Conduct inspections of operations along its pipelines to insure that construction does not risk the integrity of its pipelines. (Class II, Priority Followup) (P-76-88)

"Insure adequate communications with contractors and other parties through written, substantiated means during excavation work including testhole verification for the depth and location of its pipelines. (Class II, Priority Followup) (P-76-89)

"Join any "one-call" systems in areas where its pipelines operate and help to organize systems where they do not exist. (Class II, Priority Followup) (P-76-90)"

-- to the State of California Department of Transportation:

"Develop guidelines for preconstruction meetings, which should include methods of preventing damage to underground utilities to be encountered during the proposed construction work. Such preconstruction meetings should be attended by all operators whose facilities are involved. (Class II, Priority Followup) (P-76-91)"  
(The Safety Board made this same recommendation to the American Public Works Association on February 2, 1973.)

"Cooperate and coordinate with those groups attempting to establish a "one-call" notification system in southern California and other areas of the State where none exist, and work with systems already in existence. (Class II, Priority Followup) (P-76-92)

"Require, as a prerequisite of a contract award, that the contractor be in contact with the "one-call" notification system or the individual facilities operators to determine the precise depth and location of any underground facilities before beginning the project. (Class II, Priority Followup) (P-76-93)"

-- to the American Petroleum Institute, the American Gas Association, and the Interstate Natural Gas Association of America:

"Advise member companies whose facilities are exposed to excavation construction projects to take immediate action to mark and locate their facilities accurately. (Class II, Priority Followup) (P-76-94)"

-- to the Griffith Company and C. W. Poss, Inc.:

"Cooperate and coordinate with those groups attempting to establish a "one-call" system in areas in which they conduct excavation activities. (Class II, Priority Followup) (P-76-95)"

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

/s/ WEBSTER B. TODD, JR.  
Chairman

/s/ KAY BAILEY  
Vice Chairman

/s/ PHILIP A. HOGUE  
Member

/s/ WILLIAM R. HALEY  
Member

FRANCIS H. McADAMS, Member, did not participate in the adoption of this report.

December 9, 1976



APPENDIX A

This report is based on an investigation by the National Transportation Safety Board under the authority of the Independent Safety Board Act of 1974. The Office of Pipeline Safety Operations of the Department of Transportation, the California Department of Transportation, the Los Angeles Police Department and the Standard Oil Company of California cooperated in the investigation.

APPENDIX B

Extract from special provisions section of construction contract  
Section 10

10-1.05 OBSTRUCTIONS.--Attention is directed to Sections 8-1.10, "Utility and Non-Highway Facilities," and 15, "Existing Highway Facilities," of the Standard Specifications and these special provisions.

The sixth paragraph of Section 8-1.10, "Utility and Non-Highway Facilities," of the Standard Specifications is amended to read:

Attention is directed to the possible existence of underground main or trunk line facilities not indicated on the plans or in the special provisions and to the possibility that underground main or trunk lines may be in a location different from that which is indicated on the plans or in the special provisions. The Contractor shall ascertain the exact location of underground main or trunk lines whose presence is indicated on the plans or in the special provisions, the location of their service laterals or other appurtenances, and of existing service laterals or appurtenances of any other underground facilities which can be inferred from the presence of visible facilities such as buildings, meters and junction boxes prior to doing work that may damage any of such facilities or interfere with their service.

If the Contractor discovers underground main or trunk lines not indicated on the plans or in the special provisions, he shall immediately give the Engineer and the Utility Company written notification of the existence of such facilities. Such mains or trunk lines shall be located and protected from damage as directed by the Engineer and the cost of such work will be paid for as extra work as provided in Section 4-1.03D. The Contractor shall, if directed by the Engineer, repair any damage which may occur to such main or trunk lines. The cost of such repair work, not due to the failure of the Contractor to exercise reasonable care, will be paid for as extra work, as provided in Section 4-1.03D. Damage due to the Contractor's failure to exercise reasonable care shall be repaired at his cost and expense.

In general, where it is necessary to construct, install or relocate underground facilities in existing cross streets requiring revisions, and other areas, such work will be done by the respective owners upon completion of rough grades (0.3-foot  $\pm$  from grading plane) at each location.

Portions of existing utility lines interfering with the work and abandoned by the owners shall be removed and disposed of outside the highway right of way in conformance with Section 7-1.13 of the Standard Specifications.



Some Utility Companies may raise their manholes to grade prior to paving. The Contractor will be expected to work around these raised-to-grade manholes during his paving operation. Full compensation for said work shall be considered as included in the prices paid for the various contract items of work involved and no additional compensation will be allowed therefor.

The tops of two existing reinforced concrete boxes at Stations 384+18+ and 384+54+, east of LaCienega Avenue, as shown on utility plans and storm drain plans, are located above the grading plane.

The Los Angeles Department of Water and Power will install a new water line 8 to 12 inches in diameter in Venice Boulevard for the entire length of the project and said installation shall be coordinated with the installation of storm drain facilities. The line will be installed 5 to 10 feet south of the new north curb line and at a depth of approximately 42 inches.

The Contractor shall allow the Department of Water and Power 80 working days to install the water line.

